

## ON THE CLASSIFICATION OF EUCALYPTS.

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No genus, whether in reference to the identification of species, or the arranging of them in groups, has given more trouble to botanists than that of *Eucalyptus*. In the early days of the colony, when only a few species were known, it was considered that they might be divided into sections according to the shape of the operculum or lid of the flower-buds, and hence Willdenow in his *Species Plantarum* (1799) arranges all the species then known, amounting only to 12 in number, under the two divisions (1) operculo conico, and (2) operculo hemisphærico.

With the exception of *E. obliqua*, L'Héritier (which, according to Baron F. von Mueller, was the first of all the species rendered known in Europe, having been collected in Tasmania shortly before the foundation of the colony of N. S. Wales), the species recorded by Willdenow were found in the primeval forests around Port Jackson, probably on the spot where Sydney now stands. His list is as follows:—

## (1) Operculo conico.

<i>E. robusta</i> , Sm.	<i>E. resinifera</i> , Sm.
<i>E. pilularis</i> , Sm.	<i>E. capitellata</i> , Sm.
<i>E. tereticornis</i> , Sm.	<i>E. saligna</i> , Sm.

## (2) Operculo hemisphærico.

<i>E. botryoides</i> , Sm.	<i>E. obliqua</i> , L'Hér.
<i>E. hæmastoma</i> , Sm.	<i>E. corymbosa</i> , Sm.
<i>E. piperita</i> , Sm.	<i>E. paniculata</i> , Sm.

(1) As far as can be ascertained from the short descriptions of these species, *E. robusta* is known by the popular name of "Swamp

Mahogany;" *E. pilularis*, "Blackbutt"; *E. tereticornis*, "Grey Gum"; *E. resinifera*, first of all "Red Ironbark," but according to the *Flora Australiensis* "Red Mahogany"; *E. capitellata*, the coast form of "Stringy-bark;" and *E. saligna*, "Blue or Flooded Gum." The specific name is not appropriate, as the leaves are only exceptionally narrow and willow-like, being generally of the size and form represented in Baron Mueller's *Eucalyptographia* (Vol. I., Dec. 2).

(2) *E. botryooides* is known as "Bastard Mahogany"; *E. hæmasstoma*, "White Gum"; *E. piperita*, "Peppermint"; *E. obliqua*, the form of "Stringy-bark" common to Tasmania, Victoria, and the southern part of N. S. Wales; *E. corymbosa*, "Blood-wood"; and *E. paniculata*, "White Ironbark."

The plan of arranging the species according to the shape of the operculum was followed by D'CANDOLLE with certain modifications; and GEORGE DON, F.L.S., in enumerating the species in 1832, gives descriptions of them in a similar manner. He remarks, on the authority of R. BROWN, that there were in New Holland (as Australia was then called) about 100 species, but "hardly half of that number were rightly known." His list is as follows:—

#### I. ALTERNIFOLIÆ.

\* Operculum conical, longer than the calycine cupula.

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|---------------------------------|--------------------------------|
| 1. <i>E. cornuta</i> , Labill.  | 3. <i>E. resinifera</i> , Sm.  |
| 2. <i>E. tereticornis</i> , Sm. | 4. <i>E. longifolia</i> , Link |

\*\* Operculum conical, equal in length to the cupula.

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|-----------------------------------|-----------------------------------|
| 5. <i>E. robusta</i> , Sm.        | 11. <i>E. virgata</i> , Sieb.     |
| 6. <i>E. marginata</i> , Sm.      | 12. <i>E. micrantha</i> , DC.     |
| 7. <i>E. incrassata</i> , Labill. | 13. <i>E. stellulata</i> , Sieb.  |
| 8. <i>E. persicifolia</i> , Lodd. | 14. <i>E. oblonga</i> , DC.       |
| 9. <i>E. punctata</i> , DC.       | 15. <i>E. viminalis</i> , Labill. |
| 10. <i>E. acervula</i> , Sieb.    | 16. <i>E. capitellata</i> , Sm.   |
|                                   | 17. <i>E. saligna</i> , Sm.       |

\*\*\* Operculum nearly conical or hemispherical, shorter than the cupula.

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|------------------------------------|---------------------------------|
| 18. <i>E. ovata</i> , Labill.      | 27. <i>E. Lindleyana</i> , DC.  |
| 19. <i>E. scabra</i> , Dum. Cours. | 28. <i>E. botryoides</i> , Sm.  |
| 20. <i>E. pilularis</i> , Sm.      | 29. <i>E. piperita</i> , Sm.    |
| 21. <i>E. radiata</i> , Sieb.      | 30. <i>E. pallens</i> , DC.     |
| 22. <i>E. stricta</i> , Sieb.      | 31. <i>E. obliqua</i> , L'Hér.  |
| 23. <i>E. hæmastoma</i> , Sm.      | 32. <i>E. corymbosa</i> , Sm.   |
| 24. <i>E. ligustrina</i> , DC.     | 33. <i>E. paniculata</i> , Sm.  |
| 25. <i>E. amygdalina</i> , Labill. | 34. <i>E. gneorifolia</i> , DC. |
| 26. <i>E. ambigua</i> , DC.        | 35. <i>E. obtusifolia</i> , DC. |

\*\*\*\* Operculum hemispherical, much broader than the cupula.

36. *E. gomphocephala*, DC.

\*\*\*\*\* Mature operculum depressed in the centre, where it is umbonate, shorter than the cupula.

37. *E. globulus*, Labill.

## II. OPPOSITIFOLIÆ.

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|-------------------------------------|-----------------------------------|
| 38. <i>E. diversifolia</i> , Boupl. | 40. <i>E. cordata</i> , Labill.   |
| 39. <i>E. pulvigeræ</i> , Cunn.     | 41. <i>E. pulverulenta</i> , Sims |

### *Doubtful Species.*

\* Leaves opposite.

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|-----------------------------------|---|
| 42. <i>E. glauca</i> , DC.        | 45. <i>E. Cunninghamsi</i> , Don          |
| 43. <i>E. purpurascens</i> , Link | 46. <i>E. rigida</i> , Hoff.              |
| 44. <i>E. tuberculata</i> , Parm. | 47. <i>E. hypericifolia</i> , Dum. Cours. |

\*\* Leaves alternate.

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|---------------------------------------|---------------------------------|
| 48. <i>E. microphylla</i> , Willd.    | 51. <i>E. elongata</i> , Link   |
| 49. <i>E. stenophylla</i> , Link      | 52. <i>E. media</i> , Link      |
| 50. <i>E. myrtifolia</i> , Link       | 53. <i>E. reticulata</i> , Link |
| 54. <i>E. umbellata</i> , Dum. Cours. |                                 |

No change was proposed for the classification of the Eucalypts until 1858, when Baron Mueller, in a paper read before the Linnean Society, suggested what may be termed the "cortical system," or a mode of arranging the species according to the structure of the bark, whilst at the same time he directed attention to the valves of the fruit as affording an additional character for the identification of species. The Baron's monograph refers especially to the Eucalypts of tropical or sub-tropical Australia, but the suggestions contained in it may be applied to the whole genus, and they have certainly proved exceedingly useful in determining species previously doubtful, and of showing that the comparative length of the operculum is not always a safe guide.

The Baron, in offering the cortical system as a contribution towards the better arrangement of the Eucalypts, speaks of it as one accommodated to the use of the colonists, regarding it evidently as a popular way of grouping the species according to their appearance in a living state, and of ascertaining whether it might not ultimately afford a means of placing them in appropriate sections. He proposed, therefore, to divide the genus into six sections:—

- (1) *Leiphloia*, or smooth-barked trees, such, for instance, as the "White," "Blue," and "Red Gums."
- (2) *Hemiphloia*, or half-barked trees, as "Box" and "Blackbutt."
- (3) *Rhytiphloia*, or trees with wrinkled persistent bark, as "Bloodwood," and "Peppermint."
- (4) *Pachyphloia*, or trees with persistent fibrous bark, as "Stringybark" and the "Mahoganies."
- (5) *Schizophloia*, or trees with persistent deeply furrowed bark, as the "Ironbarks."
- (6) *Lepidophloia*, or trees with the bark persistent on the trunk only, and forming separate pieces, as the "Moreton Bay Ash."

The 38 species enumerated by the Baron are arranged in the following manner:—

## I. LEIOPHLOIÆ.

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|----------------------------------|-----------------------------|
| 1. <i>E. tereticornis</i> , Sm.  | 7. <i>E. dichromophloia</i> |
| 2. <i>E. rostrata</i> , Schlecht | 8. <i>E. hemilampra</i>     |
| 3. <i>E. signata</i>             | 9. <i>E. bigalerita</i>     |
| 4. <i>E. variegata</i>           | 10. <i>E. latifolia</i>     |
| 5. <i>E. citriodora</i> , Hook.  | 11. <i>E. platyphylla</i>   |
| 6. <i>E. brevifolia</i>          | 12. <i>E. aspera</i>        |

## II. HEMIPHLOIÆ.

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|-----------------------------|-----------------------------|
| 13. <i>E. tessalaris</i>    | 14. <i>E. semicorticata</i> |
| 15. <i>E. confertiflora</i> |                             |

## III. RHYTIPHLOIÆ.

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|---------------------------|----------------------------|
| 16. <i>E. polycarpa</i>   | 21. <i>E. patellaris</i>   |
| 17. <i>E. terminalis</i>  | 22. <i>E. trachyphloia</i> |
| 18. <i>E. tectifera</i>   | 23. <i>E. bicolor</i> A.C. |
| 19. <i>E. leptophleba</i> | 24. <i>E. populnea</i>     |
| 20. <i>E. microtheca</i>  | 25. <i>E. ferruginea</i>   |

## IV. PACHYPHLOIÆ.

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|-----------------------|---------------------------|
| 26. <i>E. fibrosa</i> | 28. <i>E. ptychocarpa</i> |
| 27. <i>E. exserta</i> | 29. <i>E. tetradonta</i>  |

## V. SCHIZOPHLOIÆ.

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|----------------------|----------------------------|
| 30. <i>E. crebra</i> | 31. <i>E. melanophloia</i> |
|----------------------|----------------------------|

## VI. LEPIDOPHLOIÆ.

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|-----------------------------|------------------------|
| 32. <i>E. aurantiaca</i>    | 33. <i>E. phænicea</i> |
| 34. <i>E. melissodora</i> . |                        |

## SECTIO DUBIA.

- |                                |                           |
|--------------------------------|---------------------------|
| 35. <i>E. brachyandra</i>      | 37. <i>E. odontocarpa</i> |
| 36. <i>E. clavigera</i> , A.C. | 38. <i>E. pachyphylla</i> |

As a further assistance in describing species of *Eucalyptus*, the Baron next suggested that attention should be paid to the shape and opening of the anthers; and in his *Fragmenta Phytographiæ Australiæ*, Vol. II. (1861), in which he devoted 38 pages to the consideration of the genus, he notes particularly the form and colour of the anthers. I am not aware that any previous botanist

had noticed with a view to classification that the variations in the stamens afforded a means whereby species might be grouped together; but Mr. Bentham, in arranging the species of *Eucalyptus* in the *Flora Australiensis*, not only described with accuracy the form of the anthers in each species, but made the variations a basis for the elaboration of his antheral system. In the *Flora*, Vol. III. (1866), that eminent botanist tells us of the difficulties he had experienced in grouping the species. The comparative length of the operculum, the shape and position of the leaves, the character of the inflorescence and fruit, and the nature of the bark (of which in dried specimens he was totally unable to judge), had all failed to give him a satisfactory mode of classification. He says:—"I have thus been compelled to establish groups upon such characters as appeared to me the most constant among those which are supplied by the specimens: in the first place upon the form of the anthers, and secondly upon that of the fruit, and in some cases on the inflorescence or the calyx." It is evident that Mr. Bentham regarded his arrangement as simply provisional, for he expresses a hope that Baron Mueller, "from his knowledge of the gum-trees in a living state, might be able to devise a truly natural arrangement founded upon the proposed cortical system, or any other system which experience may induce him to adopt."

So far as the stamens are concerned, Mr. Bentham grouped the species in the following manner:—

Series I.—*Renantheræ*, or such as have the anthers reniform or broad and flat.

Series II.—*Heterostemonæ*, or those which have the outer stamens anantherous.

Series III.—*Porantheræ*, or those that have small and globular anthers.

Series IV.—*Micrantheræ*, or those having small globular anthers.

Series V.—*Normales*, or those with oblong-ovate or nearly globose anthers opening longitudinally.

The other series are founded on the inflorescence, the shape of the calyx, the position of the valves in the fruit, and the nature of the fruit itself.



In his preface to the *Eucalyptographia*, 1880, (in which 100 species are figured and described), Baron Mueller has adopted Mr. Bentham's system, with certain modifications, for all the Eucalypts in Australia. Whilst still retaining the opinion that the "cortical system" is useful for work in the field, he recognises the anthereal system as most convenient for arranging specimens in the museum. Without, however, finally arranging his figures according to any fixed plan, the Baron says, that, on full consideration, he has deemed it best to leave the lithograms unnumbered, so that any one who "had occasion to utilise his work might arrange the plates either in accordance with the method derived from the stamens, or according to the cortical system, or, if he should think it more convenient, alphabetically."

The anthereal system, as modified by the Baron, is thus explained:—

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| I. — <i>Renantherece</i>   | } as already indicated in the <i>Flora</i> . |
| II. — <i>Porantherece</i>  |  |
| III.— <i>Strongylantherece</i> , having anthers not or scarcely longer than broad, usually round, opening by longitudinal slits. |  |
| IV.— <i>Orthantherece</i> , having anthers distinctly longer than broad, opening by almost parallel slits.                       |  |

In tracing the study of *Eucalyptus*, it may be seen how difficult it is to fix on any peculiar characters for the determination and grouping of species. Before R. BROWN had visited these shores and had returned to Europe with 4000 specimens of plants almost new to science, few species of Eucalypts were known. Nor do they appear to have received much addition from the labours of that eminent man, for as his collections were made either at Port Jackson, or on the coasts of Australia when voyaging with Flinders (1801-1805), he had no opportunity of discovering any inland species. BROWN, however, was the first to notice that some of the Eucalypts had a double operculum, the outer, in his opinion, being in the form of a calyx, and the inner in that of a corolla. The species connected with his name are:—

*E. calophylla*, R.Br. ; Western Australia.

*E. grandifolia*, R.Br. ; Northern Australia.

*E. perfoliata*, R.Br. ; Northern Australia.

*E. Baxteri*, R.Br. ; probably from Kangaroo Island, and now regarded as a variety of *E. santalifolia*, F.v.M.

*E. hypericifolia*, R.Br. ; from Risdon Cove, Tasmania, and now joined with *E. amygdalina*, Labill.

*E. Risdoni*, Hook. ; collected by Brown at Risdon Cove.

*E. clavigera*, A. Cunn. ; collected by Brown at Careening Cove, Northern Australia.

CALEY, who resided in Parramatta from 1800 to 1810, when only a small portion of the colony was known, could not have noticed any of the Eucalypts excepting in those parts now distinguished as the County of Cumberland and Hunter's River, so his name does not appear to be connected with the genus. Caley's time was not exclusively devoted to botany, for he made valuable collections in every department of natural history. It appears that he was the first to send to Europe specimens of the "Red-flowering Ironbark," and the large variety of the "Swamp Mahogany." He also collected specimens of the following species :—

*E. polyanthema*, Schau

*E. viminalis*, Labill.

*E. bicolor*, A. Cunn.

*E. maculata*, Hook.

*E. longifolia*, Lk. and Otto.

*E. eugenioides*, Sieb.

*E. siderophloia*, Benth.

CALEY was one of the first that made any progress in crossing the Blue Mountains, and advanced as far as the place called "Caley's Repulse," marked by a heap of stones near Woodford ; but all his specimens of Eucalypts were collected in what is now known as the County of Cumberland. On his return to Europe, he was offered by the King of Prussia £350 for his collection of birds, but he refused the money and generously presented them to the Linnean Society, as he thought it discreditable for them to go out of England.

It was not until the Blue Mountains had been crossed by WENTWORTH, BLAXLAND, and LAWSON in 1813, that the distinguished botanist and explorer, ALLAN CUNNINGHAM, had an opportunity of collecting specimens on the Mountains and beyond the



Dividing Range. He accompanied Lieut. OXLEY, then Surveyor-General of the colony, in his expedition to explore the Lachlan in 1817, and subsequently visited Liverpool Plains by a practicable pass over the Range. In these expeditions he discovered several new species, whilst about the same period SIEBER appears to have collected specimens on the Blue Mountains. CUNNINGHAM was indefatigable in sending collections to Europe, but such was the apathy of those days in reference to botanical discoveries in Australia, that many of his packages remained unopened for nearly a quarter of a century; and it was not until Mr. BENTHAM was engaged in preparing, with the assistance of Baron MUELLER, his great work on the Flora of Australia, that CUNNINGHAM'S labours were in any way appreciated. It must be admitted that the genus *Eucalyptus* was not a favourite with our early botanists. They found so much difficulty in distinguishing one species from another, that it used to be said the workmen at Port Jackson knew more about the different kinds of Eucalypts than those who endeavoured to define species by the usual characters. Even within my recollection, it was maintained by some that many of what are now regarded as species were simply varieties, whilst it was asserted by others that a process of hybridisation was going on amongst them. In the English Encyclopædia, which was published in 1854, a writer remarks "in many species the leaves are so variable in their form and other characters at different ages of the tree, or in different situations, that it is a matter of difficulty to know how they are to be botanically distinguished from each other; and in fact the subject of the distinction of species has hardly yet been taken up, no botanist feeling competent to undertake the task without some personal acquaintance with the plants in a native state. The leaves, instead of presenting one of their surfaces to the sky and the other to the earth, as is the case with the trees in Europe, are often arranged with their faces vertical, so that each side is equally exposed to the light." He then goes on to lament over the difficulty of understanding the names by which the colonists call Eucalypts in different parts of Australia, and expresses a wish that some settled nomenclature may be introduced.



The labours of BENTHAM and MUELLER have formed a new era in the history of *Eucalyptus*. They have enabled us to identify species but little known a quarter of a century ago, and to refer to their proper places in a systematic arrangement all the known Eucalypts. It is to be hoped, therefore, in due course that a "settled nomenclature" may be devised, and that the obscurities arising from "local names" may be cleared up. In reviewing the different modes adopted for describing and grouping the species, it will be seen that, whilst some of the former characters have been abandoned, or are now only partially relied on, the cortical and antheral systems have thrown much light on a subject which all botanists, from the days of BROWN to the present time, have regarded as beset with many difficulties.

The first mode of arranging species, as already stated, was founded on the comparative shape and length of the operculum. This method, if adopted only in arranging the specimens of the last century, is now found to be misleading, for the operculum of *E. saligna* is sometimes conical and sometimes hemispherical, and this seems to have led to some confusion in mixing together the specimens of two very different species, the one a gum-tree, generally with smooth bark (*E. saligna*), and the other a mahogany with fibrous bark (*E. botryoides*), and differing very much in habit. As the genus became better known, and more species were added to Willdenow's list, it was found that some had variable opercula, especially in *E. viminalis*, and the larger forms of *E. hæmastoma*, *E. resinifera*, and *E. punctata*, and that the double opercula were confined to a few species, such as *E. globulus*, *E. maculata*, *E. eximia*, and *E. peltata*. For a long time, however, the system of classifying by the operculum was continued for the want of any better, and it was sought by means of noting other peculiarities in that organ, and by recording the shape and position of the leaves, to distribute the species with some degree of regularity. Those who paid any attention to Eucalypts before MUELLER and BENTHAM devised their respective systems, are well aware of the mistakes which arose from trusting to any descriptions founded simply on the character of the opercula and the

leaves, and they recognise the difficulty of relying on brief descriptions, which, according to the judgment of different observers, were sometimes applied to very different trees. In referring to some of the lists which were published half a century since, it is amusing to notice the mistakes that occurred in the misapplication of botanical names. Thus, for instance, the blue-gum (*E. saligna*) was referred to *E. piperita*, or the peppermint; the stringy-bark (*E. capitellata* or *E. eugenoides*) to *E. robusta* the swamp mahogany; white gum (*E. haemastoma*) to *E. tereticornis*, grey gum or bastard box; and spotted gum (*E. maculata*) to *E. haemastoma*. It is no wonder that the systematic arrangement proved so fallacious, when it is considered that the operculum, even in the same species, is subject to variation, and that the leaves are of various shapes and sizes on the same kind of trees. This is seen in some species more than in others, whilst, as Mr. BENTHAM found, as the result of long observation, that no sure diagnostic characters could be taken from such sources. It is true that in some species the venation is well defined, and that even a few may be determined by the shape of the leaf, but these are exceptional cases; and perhaps of all known genera no genus affords less assistance to the systematic botanist in the character of its foliage than *Eucalyptus*. When, therefore, so many difficulties presented themselves from previous endeavours to classify our Eucalypts, Baron Mueller's plan of grouping them according to the nature of their bark was hailed with satisfaction by observers in these colonies. The system, it is true, cannot be appreciated by European botanists, or those who have not an opportunity of seeing the trees in a living state; but to persons who are studying the species as they appear in their native forests, it affords an easy method of referring them to a recognised position. Besides, the terms "Gums," "Stringy-barks," and "Iron-barks" are so natural and familiar to the colonists, that any system founded on the smooth, fibrous, or rugged character of the bark, commends itself to them. The cortical system, therefore, has proved a step in the right direction, and it may be regarded as a popular method of overcoming some portion of the difficulty which has attended

the study of our Eucalypts. But, after all, as the learned Baron himself would acknowledge, the system is only an instalment towards the object sought after, for as certain trees are as variable in their bark as others are in their leaves, his sectional arrangement does not hold universally. There are exceptions, for instance, to the *Leiphloie*; for *E. hæmastoma*, *E. saligna*, *E. viminalis*, *E. stellulata*, and *E. punctata* are sometimes half-barked, whilst instances occur in which *E. tereticornis* has fibrous bark. The different kinds of Box are not always half-barked, and so some of the *Hemiphloie* incline to the *Leiphloie* in extreme age. I have noticed this peculiarity in *E. largiflorens*, and in some of the blackbutts (*E. pilularis*). The fibrous-barked trees, such as blood-wood, stringy-bark, and mahogany, are less liable to variation in the bark; but in the woolly-butt (*E. longifolia*), of which the Baron regards the bark as wrinkled, somewhat fibrous and persistent, I have seen old trees which might have been mistaken for *E. tereticornis*, their trunks having completely shed their bark and become similar to gum-trees. This species, however, is well defined by its large flowers and fruits, usually in threes; but the specific name *longifolia* is scarcely applicable to the trees as they advance in age. The iron-bark group (*Schizophloie*) is less liable to variation in the nature of its bark than any of the preceding sections; and yet in some forms of *E. paniculata* the bark is less rough and deeply furrowed than in its allies, whilst in exceptional cases, when it goes under the popular names of "Iron-bark Box," and "Bastard Iron-bark," the wood and fruit are those of iron-bark, but the bark less rugged. Some years ago, when the late Mr. Thomas Shepherd was residing with Mr. Bell, at Cabramatta, he called my attention to a tree which, so far as its general characters were concerned, appeared to be an iron-bark, the shape of the buds, flowers, and fruit being similar to those of *E. paniculata*, and the wood being, in the opinion of the workmen, like the ordinary iron-bark of the neighbourhood. Mr. Shepherd called the tree "Black Box" and "Iron-bark Box," and entertained an idea that it might be an undescribed species. Although I have had specimens of this tree for some

years, it is only of late that I have come to the conclusion that the tree in question is really an iron-bark, for on Mr. H. Bray's property at Concord a similar one has been pointed out to me. This the workmen called "Bastard Iron-bark," as the wood resembles that of iron-bark, whilst the bark is not furrowed as iron-barks usually are, but is more like that of box or woolly-butt. Having examined the fruit and leaves of this tree, and having ascertained that the wood is similar to that of iron-bark, I am now convinced that the tree which puzzled Mr. T. Shepherd and that growing in Mr. Bray's paddock are identical, both of them being varieties of *E. paniculata*. If hybridisation were possible in the genus, one would think that the "Iron-bark Box" is a cross between iron-bark and box, but according to the opinion of the late eminent naturalist W. S. MACLEAY, F.L.S., the impregnation of the flowers takes place before the operculum falls off, and hence in such a case crossing cannot be effected. As this matter has never been carefully investigated by any observer, nothing like certainty can be affirmed of the probability or improbability of hybridisation. If, indeed, such a contingency might be supposed, it would relieve us of many difficulties in the fixing of species, and lead to the belief that some of the forms which resemble each other closely in flowers and fruit, but differ only in wood and bark, are merely varieties. If nature does not admit of crossing in the genus *Eucalyptus*, it certainly encourages that of grafting, for, in the neighbourhood of Mudgee, "the Apple" (*Angophora intermedia*) may be seen grafted naturally on *E. rostrata*, whilst, on the Richmond Common, a similar eccentricity may be seen on *E. tereticornis*. Whatever may be discovered, however, in reference to natural changes which may be going on amongst our Eucalypts, Baron Mueller's cortical system is one of the greatest utility, for although there are exceptional cases in which there is some uncertainty from variation of the bark in the same species, yet, generally speaking, his grouping can be maintained, and in cases where the bark seems abnormal or differing from the ordinary type, mistakes may be obviated by an examination of the flowers and fruits.



The anthereal system, which was in some degree suggested by Baron Mueller's descriptions in his *Fragmenta*, and was subsequently worked out with great ingenuity by Mr. Bentham in the *Flora Australiensis*, is that now generally adopted by botanists. The Baron, in his preface to his *Eucalyptographia*, expresses the opinion that it is most convenient for the arranging of specimens in herbaria, and that the method brings also into close contact most of the Eucalypts which are bound together by natural affinity. But whilst these great men have rendered incalculable assistance in the classification of the genus, it remains for further investigation to clear up the anomalies which still exist in the anthereal system. Though as a system for grouping the species it proves so useful, yet it must be confessed that it is not so satisfactory to the general observer, or to one who has not the leisure for microscopic investigations. When the anthers are small or in their configuration vacillating between two sections, a powerful lens or even a microscope may be necessary for accurate determination. Few persons have the time or the ability for such examinations, and, therefore, whilst the system may give great assistance to the scientific botanist in his museum, it cannot be of general use in the field or to the majority of observers. Nor, indeed, is it without its difficulties to the botanist, for, as the Baron candidly acknowledges, some species may be regarded as transits from one section to another, and that the characteristics of aberrant forms of any species are not covered by his synopsis. It is probable that as the species become better known and those of one district are compared with those of another, the general characters of the anthers in such species may be more accurately determined; but still the difficulty must remain of subjecting the floral organs to minute inquiry, or indeed of finding the anthers in a proper state for examination. Though, in the majority of instances, the anthereal system brings into close contact species allied by natural affinity, yet there are some remarkable exceptions to the rule. For instance, some of the "Iron-barks" stand in Poranthereæ, and others in Parallelanthereæ. The same may be said of some of the "Mahoganies;" whilst a few of the "Gum Trees" are separated from those very similar in



appearance. But these irregularities, as they would be popularly regarded, are of much less importance than mistakes which have arisen from a too rigid application of the anthereal system without reference to the bark, wood, or habits of certain trees. In the excellent "Forest Flora of South Australia" by Mr. J. E. BROWN, F.L.S., two such instances occur, the first in *E. leucoxylo*n, F.v.M., and the second in *E. paniculata*, Sm. The former of these is called in South Australia "White Gum," "Blue Gum," and "Pink Gum," and from the character of its bark it stands in the Baron's *Leizophloia*. Its specific name denotes that the wood is white, and the tree is said to assume a variety of forms. Now, by adhering too strictly to the anthereal system, this gum tree is said to be identical with our "Red-flowering Iron-bark" of Eastern Australia, a tree remarkable for the dark colour of its wood, and the deep fissures of its rough bark. There is certainly great similarity in the flowers and fruit, but to those who have had opportunities of seeing the two trees in their native forests, it seems marvellous that they should be regarded as the same species. Our red-flowering iron-bark is Cunningham's *E. sideroxylo*n, and I believe that Baron Mueller now recognises it as such. *E. paniculata* is called in South Australia the panicle-flowered "White Gum," a small tree never found to exceed 30 or 40 feet, having deciduous bark, light-coloured wood, and a stunted spreading habit. There can be no doubt that the true *E. paniculata* belongs to Port Jackson, as it was one of the first of which specimens were forwarded from N. S. Wales to Europe, and which, since the publication of the *Flora Australiensis*, has been identified as the "Pale or White Iron-bark" (so called to distinguish it from the iron-barks with darker wood). This tree rises to 100 feet and upwards, has very tough wood, persistent bark, and an upright habit. The two trees, notwithstanding the close resemblance of flowers and fruit, must be regarded as two distinct species. Another instance occurs in *E. polyanthema*, under which the "Poplar-leaved Box" or "Lignum vitæ" of the low country is confused with the "Red Box or Slaty Gum" beyond the Dividing Range. The trees differ very much from each other in bark, wood, and habit, for whilst

that of the low country is a small tree with hard dark-coloured wood and little esteemed, the "Red Box" beyond Mudgee is a fine tree with wood highly valued in the building of bridges, &c.

In the consideration of specific differences, little stress has been laid on the nature and position of leaves, because they are so variable even in the same species. It is true that some have alternate, and some opposite leaves, and some have the leaves opposite when young, and alternate as they grow older; but these variations do not afford any character for sectional division. The trees which have opposite leaves are chiefly :—

<i>E. pulverulenta</i> (including	<i>E. tetragona</i> (nearly so)
<i>E. cinerea</i> )	<i>E. odontocarpa</i> } (opposite or
<i>E. melanophloia</i>	<i>E. tetradonta</i> } alternate)
<i>E. cordata</i> (Tasmania)	<i>E. gamophylla</i>
<i>E. macrocarpa</i>	<i>E. setosa</i>
<i>E. perfo'iata</i>	<i>E. pruinosa</i> (nearly)
<i>E. erythrocorys</i> (nearly so)	<i>E. doratocylon</i> (nearly)

Those which have the leaves opposite when young are :—

<i>E. viminalis</i>	<i>E. Stuartiana</i>
<i>E. pilularis</i>	<i>E. goniocalyx</i>
<i>E. globulus</i>	<i>E. amygdalina</i>

To these may be added a few species which appear with opposite leaves simply as seedlings; but it does not seem probable that, even with a more extensive knowledge of the foliage (desirable as such information is), much advantage would be gained in the way of classification.

Some have thought that, in the determination of doubtful species, the texture of the wood should be considered. It is no doubt very useful for cabinet purposes to collect specimens of the wood; and the late Sir William Macarthur was in the habit of having such neatly arranged in the form of books. I could imagine that a set of Eucalypt woods, carefully polished so as to exhibit the grain for examination, would assist materially in the identification of some species, but I cannot think that 150 different kinds of woods, arranged in the way specified, would contribute much towards classification. I have been told by practical men that the timber of some trees differs very much in proportion to

its age, and that even in some cases one side of a tree has better wood than the other. The soil also is said to affect the character of the wood. Without seeing the bark as well as the wood, even experienced men are deceived, and I have heard of cases in which inferior species have been passed off as iron-bark for railway sleepers.

The late lamented Tenison-Woods, F.G.S., F.L.S., who had paid considerable attention to the genus *Eucalyptus*, was of opinion that much might be done by studying the shape, size, and peculiarities of the seeds, and he had commenced collecting them with that view. There are great differences in the seeds, as may be seen by the figures in Baron Mueller's *Eucalyptographia*, and of the 100 species there illustrated, the following have a membrane or wing attached to them.

<i>E. abergiana.</i>	<i>E. tetragona.</i>
<i>E. pachyphylla.</i>	<i>E. ficifolia.</i>
<i>E. corymbosa.</i>	<i>E. oldfieldii.</i>
<i>E. setosa.</i>	<i>E. gamophylla.</i>
<i>E. ptychocarpa.</i>	<i>E. pyriformis.</i>
<i>E. foelscheana.</i>	<i>E. santalifolia.</i>
<i>E. todtiana.</i>	<i>E. tessalaris.</i>

It is well to place on record any further differences that may be noticed, as they may serve as notes for the fixing of species; but probably nothing is of greater importance than the shape of the fruit, the position of the capsule, the number of its cells, and the appearance of the valves. Some years ago, when writing about *Eucalyptus*, I remarked that, "viewed practically, Baron Mueller's method of grouping our Eucalypts, according to the nature and texture of the bark, is the best system which has yet been promulgated; and whilst future observations may render it more precise by defining with accuracy the particular group under which each species should be ranged, the basis of the system is likely to be permanent." The anthereal system had not then been elaborated, nor was I aware that the cortical system was liable to any serious exceptions. I do not see, however, any reason to alter the opinion I expressed, for by paying more attention to the figure and openings of the anthers than was thought of at that time, any

mistakes arising from the abnormal state of the bark may be rectified. To the passage already quoted I added, "As regards the fixing of species and of ascertaining the amount of variation to which some are liable, other principles must be applied. Some species, indeed, are marked by the double operculum, some by winged seeds, and others by the colour of their stamens; but the shape, cells, valves, &c., of the seed-vessels present very important notes of distinction and deserve the most attentive study. Hence I believe that these considerations, when taken in connection with the cortical group to which the respective species belong, will be found most efficacious in settling many difficulties." Since 1860, Baron Mueller has made wonderful progress in the description of new species and in illustrating their peculiar properties, but I still think that if any further improvement is to be made in the matter of classification, it must be by the study of their fruits. To collect the fruits of all known Eucalypts, and to form groups on the basis I have suggested, would be the work of time and might need almost a specialist; but if it be true, as the Baron is fond of saying, that not only in religion but in the study of the vegetable kingdom, species are known by their fruits, it may reasonably be expected that to the cortical and anthereal systems, a carpological one may yet be added, which will dissipate the obscurity which still rests on the true characters of some species, and render the study of *Eucalyptus* as practicable as that of any other genus. Some of our great naturalists have been so impressed with the importance of the fruit and its seed, as "constituting the crown and end of the whole nature and vitality of plants," that they have not hesitated to regard them as superior to the other parts in dignity; and probably, if the fruits of all our Eucalypts could be procured and arranged systematically according to their variations, additional light would be thrown on the matter of classification. Baron F. von Mueller has already hinted at this in his *Eucalyptographia*, and should he be spared to take a comprehensive view of the whole genus (including the species of those Eucalypts which at present are but partially known), he would add, if it were possible, to the world-wide reputation he has already acquired.